

# FIGHT AGAINST EROSION WITH PERMEABLE GROYNES

## SCALING UP THE DIOGUE EXPERIENCE

### GUIDE N°2:

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#### Guide in 4 parts:

1. Decision (village meeting),
2. Implementation (inhabitants),
3. Follow-up (schools),
4. Capitalisation (scientists).

*An educational kit completes each phase (from measuring the current to the use of the geo-referenced or non-geo-referenced drone)*

The work carried out in Diogu  serves as a pilot for application to other sites on the southern coast of Senegal. We made 8 groynes in various conditions (beach slope, sediment, wave exposure)

#### 1. Shape and layout of the posts for the basic module

This basic module is a 15-metre long and 10-metre wide groynes (7-metre branches). It requires 80 poles. You need 40 poles for the axis (2 times 20 poles) and 40 poles for the branches (2 x 10 stakes per 7-metre branch), i.e. a total of 80 stakes.



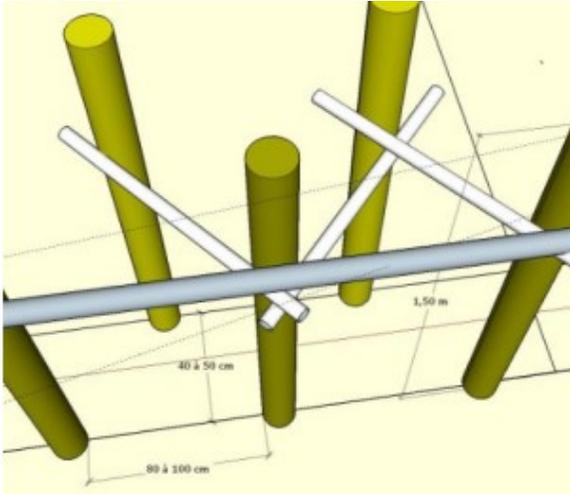
No need to plan too large: **15 to 20 metres long and 10 metres wide** will be enough to start with.

This corresponds roughly to the foreshore.

The size of each cob can be made longer at the top or be extended at the top or bottom or down in the space of a few a few hours

Figure 1: Figure 1: General shape of a groyne

**Note:** The "width" of the foreshore can be measured during a spring tide (coefficient above 70) with a tidal range<sup>1</sup> of about 1.50m.



The stakes are placed in two lines 40 to 50 cm apart. This ensures solidity thanks to the reinforcement between the stakes.

This allows palm leaves to be slipped in and to prevent them from escaping upwards or between the poles. The poles in a line should be spaced about 80 cm apart. They should be arranged in a staggered pattern so that the fins can be better held.

*A GABARIT (80 cm) shall be used.*

They will be reinforced at 1m from the ground by sticks connecting the poles of the 2 lines.

*It is advisable to use these reinforcements for the marker poles as a measure of 1m from the ground.*

**Figure 2: Layout and reinforcement of poles**

Footnote 1: *Difference in water height between low and high tide*

You have to build in stages, don't make the cobs too long and maintain them well. We will extend them towards the water when sand has been gained.

### **There are two phases to a groin:**

- **Phase 1:** Start from the high tide line (high tide - coefficient 70 to 80)
- **Phase 2:** When the sand has risen to the wings of the first spur, it is extended by a second identical spur. With a second identical groyne, the wings should be approximately halfway between high and low tide where it moves.

For Phase 2, you can proceed in several steps: first extend the vertical axis for a few metres, then the wings and then the vertical axis at the bottom. We can adjust the length before building the wings depending on the result. For example, if we see that the waves are making grooves in the sand, we will build the wings earlier.

## **2. Materials and dimensions of the poles: between 1.5m and 2m long**

The poles are made of **12-15 cm diameter** stakes, **1 m to 1.50 m high**, set **50 cm deep**.

**Eucalyptus** is currently the best material tested (2)

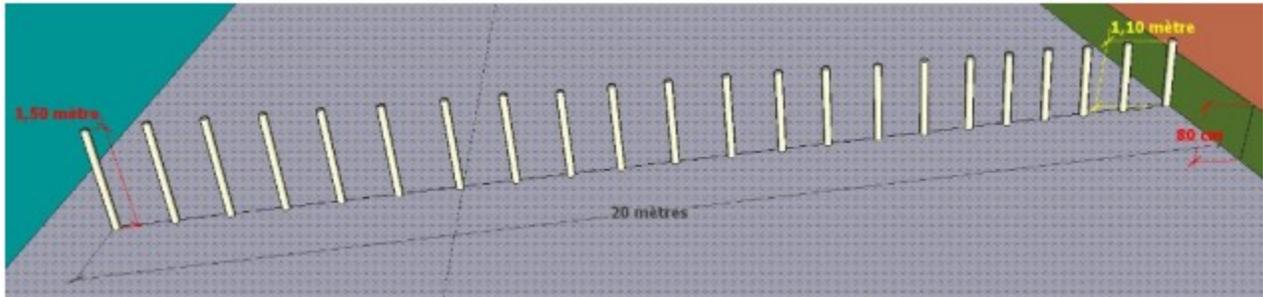
Indeed, pruned eucalyptus produces several shoots that grow quickly in a straight line and produce, in two years, enough to prune the stakes of good diameter of 2 meters long (2 to 4 stakes at least per shoot).

If the stakes are too thin they will tend to move and be capsized by waves. Too thick they will be heavy to carry and difficult to drive with the tipping technique.

At the top of the beach, one should not expect to obtain more sediment than the height of the step

that separates the beach from the mainland. The stake should therefore not exceed the step by more than 20 or 30 cm. If the step is 80 cm high, the height of the first stakes can be limited to  $80 + 30\text{cm} = 1.10\text{m}$  above the sand. As they will be set 40-50 cm deep, a **total length of 1.50 m will suffice**. At the bottom, more sand can be expected to be deposited, but 1.50 at the most. The stakes can therefore 1.50m, i.e. a total length of 2 metres.

In practice, as shown in figure 6, the longest posts should be placed towards the water (left) and the shortest towards the sea (right).



*Figure 3: Example of the distribution of posts by size. Regularity is not required*

### 3. Laying

The day of laying should be chosen according to the tide: a spring tide, in the middle of the day, means that you can start with a falling tide in the morning and finish with a rising tide in the evening.

The posts will be bluntly pointed with a machete (difficult work to anticipate). They will be driven in at ebb tide, starting at the top of the beach to take advantage of the humidity of the sand.

We start by sorting the stakes by placing the longest at the bottom, towards the water, and the shortest at the top, towards the land. The strongest poles are distributed along the length to obtain a stable structure.

Footnote 2: In Diogu  we also experimented with mangrove cutting in the congested bolongs. But cutting is difficult and is prohibited, even though the mangrove is developing well. Filaos may also be suitable, but it can break and form sharp ends if it is too thin. In Casamance, it is possible to take advantage of the thinning of plantations on Kafah or Diogu .



Figure 4: Stake size



Figure 5: Stake driving technique

The stakes can be quickly driven in 40-50 cm by moving them sideways and back and forth while applying downward pressure. A gauge (a simple stick) of 80 cm is used for the spacing. The following video shows the technique well. <https://vimeo.com/374098648>

Once the stakes are in place and already blunted, 4 or 5 active people can plant a spur on an ebb tide and reinforce and secure the fins which takes about 10 hours.

#### 4. After a tide it is useful to check that all the stakes are stable.

After this check it is possible to carry out the lining and the reinforcement at the same time. The **reinforcement with branches to a height of 1 metre** can be carried out after the first leaves or branches have been laid (so that they can be passed from above) and before the sea rises.

***Without filling, the cob will have practically no effect but too much filling will block the sand!***

Palm or coconut leaves or branches placed between the poles have a double effect:

- They trap the sand at the foot of the posts and help to solidify their fixation during the first weeks. This is the easiest effect to understand ***but it is not what will make the sea recede.***
- They contribute to slowing down the current over a distance of several dozen metres. ***This is the most important and lasting effect.***

These leaves and branches should therefore be **limited to a height of 30 to 40 cm** so as not to put up too much resistance to the current and, above all, to the waves and avoid capsizing.

**Be careful!** Even with a low palm height, the waves can still capsize some poorly driven stakes during the first week! You have to keep an eye on it every day at the beginning. When the sand level has risen and covered the fins, **add another 30 cm** to facilitate the deposition of sand until a profile is obtained that leaves the poles 20 to 40 cm above the ground. The leaves can be fixed or blocked on the poles with ropes.



Figure 1: The "garnishing" of a complete ear of corn